gravest problems that man has to grapple with; and secondly, in that it has more or less distinct reference to a past of which the present is but an outcome and a development. C. LLOYD MORGAN.

HERMANN HELLRIEGEL

PROF. HERMANN HELLRIEGEL, whose death took place at Bernburg, Anhalt, on September 24 last, was born at Pegau, Saxony, on October 21, 1831, so that he was within a month of completing his sixty-fourth year. His life, on the whole, was uneventful, for he devoted himself with studious zeal almost entirely to investigations, both chemical and physiological, into the phenomena of plant nutrition. One of his earliest official posts was that of Director of the Agricultural Experiment Station at Dahme, in Brandenburg, which was founded in 1857 by an association of agriculturists in Jüterbog-Rückenwalder. During his tenure of this post he studied experimentally the alimentary needs of certain plants which are cultivated as field crops, notably cereals, potatoes, and sugar-beet, his method involving the use of sterilised soil, both by itself and with the addition of various chemical salts. His physiological inquiries embraced observations on the growth and development of roots, on the quantity of water used in the growth and maturation of field crops, and on the minimum amounts of nitrogen, phosphoric acid, potash, and other ingredients required by plants. Supplemented by observations on crops grown in the open field, these investigations led Hellriegel to conclusions of great practical importance, notably in connection with sugar-beet, a crop which Germany grows more extensively than any other European country, its annual average area for the last twelve years having been 800,000 acres, or more than one-fourth of the entire European acreage.

It was with no little regret that in 1873 Hellriegel gave up his directorship at Dahme, though for a post with greater emoluments. But his capacity as an investigator had made its mark, and when in 1882 the Verein für Zucker-Industrie, in co-operation with the Government of the Duchy of Anhalt, established an experimental station at Bernburg, for the special investigation of problems bearing upon the cultivation of sugar-beet, it was felt that Hellriegel possessed special and peculiar claims to the directorship, which was accordingly offered to him. He accepted with avidity a post which enabled him again to devote his time and energy solely to those investigations into plant-life, which had previously exercised upon him so strong a fascination. The station at Bernburg is admirably equipped, and Hellriegel found himself in a position to at once resume his inquiries into the nutrition of leguminous plants, a subject that had previously received his attention at Dahme. It was here that after a dozen years' work he, in collaboration with Dr. Wilfarth, made the great discovery with which his name will ever be inseparably associated, namely, the capacity of leguminous (or at least of papilionaceous) plants to take up, or fix, through the agency of the micro-organisms of their root-nodules, the free or uncombined nitrogen of the atmosphere.

The intimation—the revolutionary announcement—of this startling discovery was made on September 20, 1886, in a communication to the Naturforscher Versammlung, held at Berlin, and over the agricultural chemistry section of which Dr. (now Sir Henry) Gilbert happened to be presiding—a coincidence of exceptional interest in view of the circumstance that Sir Henry Gilbert was one of the joint authors of the celebrated memoir by Lawes, Gilbert, and Pugh, "On the sources of the nitrogen of vegetation, with special reference to the question whether plants assimilate free or uncombined nitrogen" (*Phil. Trans.* 1861), which, at the time of its appearance, and for long after, was regarded as setting at rest the question as to the capacity of plants to assimilate the free nitrogen of the atmosphere, and of confirming upon this point the negative results previously obtained by Boussingault. Hellriegel's momentous discovery furnished an explanation of the long-known fact that a clover-crop leaves the soil richer in nitrogen than it finds it, and is therefore a suitable crop to precede the wheat-crop in a rotation, clover being—as we now understand through Hellriegel's discovery—a nitrogen-accumulating plant, and wheat a nitrogen-consuming one. Indeed, the fact itself is a very old one, for it was observed by the farmers of the Roman Republic that beans, lupins, vetches, and other plants belonging to the sub-order Papilionaceæ, as now defined, rendered the soil "more fruitful" for the crops that followed. But nearly 2000 years elapsed from the time when Varro recorded this, to that when Hellriegel, a brief nine years ago, supplied the explanation. It in no way detracts from the value and significance of the discovery that Hellriegel and Wilfarth should have happened upon it in the course of investigations which were really directed to quite a different object. Those who devote their lives to research are not unaware that gems, hitherto unseen, may sometimes be picked up on the wayside.

We have spoken of Hellriegel's discovery as revolutionary, and it certainly upset a long-cherished belief. The opposition which his announcement received at the outset was a testimony to its importance. Subsequent research, both in Europe and in North America, has, however, only strengthened the position which Hellriegel took up, whilst it has suggested new lines of investigation for which there will probably be no lack of workers. Bréal, Frank, Hiltner, Lawes and Gilbert, Schlœsing fils and Laurent, are but a few of the investigators who have proved the accuracy of the discovery made at Bernburg. In recognition of his work, Hellriegel was elected an honorary member of the Royal Agricultural Society of England, a rare distinction, which he enjoyed in common with such continental workers as Pasteur, Fleischmann, and Chauveau. In France his merits were recognised by his election as a foreign associate of the Société nationale d'Agriculture, and as a Correspondant of the Academy of Sciences.

NOTES.

THE German committee for the exploration of the South Polar regions met at Berlin on Sunday, and decided to send two vessels southwards from Kerguelen Island, leaving full liberty of action to the leaders. The total sum to be allotted for the expedition, which is to last three years, has been fixed at 950,000 marks (£47,500).

CHICAGO UNIVERSITY continues to be the recipient of Fortune's favours. Mr. John D. Rockefeller has (says the New York correspondent of the *Daily Chronicle*) added £200,000 to his previous gift of £800,000 for the endowment of the Chicago University. He promises £400,000 more if any one else will subscribe a like sum. When will the day come for such generous gifts to education and research in England?

THE Municipal Council of Arbois, the birthplace of Pasteur, has decided to erect a statue to his memory, and also to call the municipal college the Pasteur College.

M. BERTHELOT, the distinguished chemist, has been appointed Minister of Foreign Affairs in the new French Cabinet. He was Minister of Education in the Cabinet of 1886-87.

IT is reported that the Paris Municipality have granted £800 to the Salpêtrière Hospital for the erection of new buildings in which to treat nervous and mental affections by electricity.

THE Board of Agriculture have appointed a Departmental Committee to consider and report upon the arrangements which it is desirable to make for the sale and distribution of Ordnance Survey maps. The committee consists of the following gentlemen:—Mr. W. Hayes Fisher, M.P. (Chairman), Mr. H. Hobhouse, M.P., Mr. W. A. M'Arthur, M.P., Mr. F. a'C. Bergne (Treasury), and Mr. T. H. Elliott (Secretary to the Board). Mr. J. J. Thomson, of the Board of Agriculture, will act as the Secretary to the Committee.

THE new public museum which has lately been opened at Kasan, well deserves the attention of archæologists for its beautiful collections, the gift of A. Th. Likhacheff. The collections comprise a considerable number of golden and silver bracelets, earrings, rings, as well as of various arms and implements from the once powerful kingdom of the Volga Bulgars, on the seat of which Kasan now stands. The modern decorative art of the Kasan Tartars, as well as the dress and implements of the Chuvashes, Cheremisses, and Mordves, are also very well represented; while nearly 1500 stone implements illustrate the Stone age on the Volga and the Kama.

THE Zoological Department of the British Museum (Nat. Hist.) has recently acquired (by purchase) an important series of British fossils from the cabinets of the Rev. P. B. Brodie, of Rowington, Warwickshire. The specimens mainly illustrate the fauna and flora of the Mesozoic period, among them being several valuable types described by Owen, Egerton, Buckman, Wright, Duncan, Carruthers, Woodward, and other palæontologists. Some of the rarer genera include remains of *Hyperodapedon*, *Mastodonsaurus*, and *Cladyodon* from the Keuper sandstone of Warwick, each of which will be now represented in the National collection for the first time, from that locality.

IN September of next year, the Smithsonian Institution, which has exerted an immense influence upon the development of science in America, and which has done more than any institution to make the results of scientific work known unto the ends of the world, will celebrate its jubilee. It is stated by Dr. Brown Goode, in a historical account of the Institution, that a special volume will be published to commemorate the event, and two memorial tablets will be erected in honour of the founder in the city of Genoa, where he died June 26, 1829: one in the English church, and one upon his tomb in the beautiful little English cemetery on the heights of San Benigno.

REUTER reports the occurrence of a severe and prolonged earthquake shock in Rome at 4.30 on the morning of November 1. The Central Meteorological Bureau states that the movement of the earth began with very slight tremors, lasting from four to five seconds. Subsequently a series of strong shocks, which continued for nearly eight seconds, occurred. After a calm of a few seconds slight undulations were perceptible for about eight seconds. Two clocks in the observatory stopped, and the old tower of the Roman College was cracked a little. At Rocca di Papa, near Rome, a violent undulatory shock was felt at 4.40. It lasted seven seconds, but caused no damage. Shocks were also felt at Anzio, Velletri, Tivoli, Civita Vecchia and Fiumicino, all in the vicinity of the capital. At the latter place the earth movement was especially strong.

WE have received from Prof. G. Vicentini, of Padua, some interesting copies of microseismographic records of a distant earthquake on October 20. The instrument with which they were obtained has been briefly described in a previous note (vol. li. p. 540). The first movements, which Prof. Vicentini attributes to longitudinal waves, began about 9h. 30m., Greenwich mean time (whether a.m. or p.m. is not stated), and lasted about twenty minutes. The second series of pulsations, which he regards as due to transversal vibrations, and each of which had a period of about thirty seconds, attained their maximum intensity about 10h. 15m., and lasted until about 11h. 30m. Somewhat similar pulsations were also registered on October 4, the longitudinal vibrations commencing between 10h. 25m. and 10h. 30m., and the transversal vibrations (of long period) after 10h. 50m. So far as we are aware, no great earthquakes are known to have occurred on these days. If the disturbances are of seismic origin, they must evidently be due to very violent shocks taking place in some distant region of the globe.

THE death is announced of Dr. Albert E. Foote, of Philadelphia. Dr. Foote was born at Hamilton, in 1846. After graduating at Courtland Academy, Homer, N.Y., he entered the class of 1867 in the University of the State of Michigan, where he took the degree of Doctor of Medicine. He spent some time as an instructor at Ann Arbor, and also as Assistant Professor of Chemistry and Mineralogy in the Iowa State College. He removed to Philadelphia in 1875. He was a life member of the Academy of Natural Sciences, of the New York Museum of Natural History, and the American Association for the Advancement of Science. Dr. Foote's wide correspondence and extended travels made him well known, especially among mineralogists. His exhibits and lectures at the American Exhibition in London in 1887, and attendance at the meetings of the British Association in several years, established lasting relations with many English mineralogists. He was one of the most enthusiastic and successful of collectors, and found much of the enjoyment of life in the collection and study of minerals and meteorites.

THE *Pioneer Mail* of Allahabad is always to the front when the claims of science to a fuller recognition in India have to be urged. A leading article, in its issue of October 10, calls attention to the need for a better recognition of scientific research than at present exists there. "Buried in the archives of the Asiatic Society of Bengal," remarks our spirited contemporary, "in those of the kindred British societies, and in a few journals of the elect, is a mass of scientific literature relating to the Anglo-Indian Empire with which its Government professes to have no concern. Most of this literally priceless work has been done by Government officials in such leisure as they have been able to snatch from the daily turn at the Government mill. The Civil Service has been rich in amateur 'pandits,' but their fame is not echoed from the rocks of Simla, though it resounds in European halls of learning. In India such men were looked at askance by the Bureaucracy, and relegated to desert places. Years ago the State spoilt an excellent geologist by converting him into a Government gardener, and did the same for another by gazetting him an ornithologist. And all the while there is that great mine of palæontological wealth in the Sewaliks lying fallow since the days of Falconer—the far-away time of Cautley and the Ganges Canal. In a few cubic feet of worm-eaten Government reports are to be found the bald details of measurements which represent the Government knowledge of Indian archæology. No one has followed in the footsteps of Fergusson; his monumental work is a classic alongside with the unopen and dust-laden works of Todd in Rajasthan and many another amateur. Not very long ago Government nipped in the bud any inclination on the part of their little Geological Department to travel into regions other than those of purely economical geology. Now that General Cunningham is no more, that sole key to the history of ancient India—numismatics—would speedily rust and be lost were it not for the enthusiasm of an amateur, who is left to struggle along as best he can. A noble effort, but a lasting reflection, nevertheless, upon an enlightened Government."

EFFORTS are being made to obtain funds for the erection of a memorial to the memory of the late Joseph Thomson, the African explorer. Subscriptions may be sent to Mr. S. W.

Silver, 3 York Gate, Regent's Park, or to Mr. J. Scott Keltie, 1 Savile Row, Burlington Gardens.

A FEW particulars with reference to the Pasteur Institute, from the *British Medical Journal*, are of special interest at the present time. The receipts budget of the Institute is as follows:—The interest on £48,000, which is the amount that remains of the ublic subscription (about two-thirds of the sum subscribed, or £80,000, was spent on the ground bought for the Institute and in building). From £800 to £1200 was granted by the Minister of Agriculture in recognition of the service rendered by the anthrax vaccine, by the treatment of swine fever, and by the supply of tuberculin and mallein. A subvention is granted the Minister of Public Instruction to pay the salaries of such of the Institute staff as were formerly attached to Pasteur's laboratory. Certain profits are made by the sale of the anthrax vaccine, and others sold at a very low price to veterinary surgeons, and they realise for the Institute an income of £800. The fees paid by the pupils who attend the lectures of the Institute are also paid into the Institute treasury. Dr. Roux's antidiphtheric service is annexed to the Pasteur Institute, but has a distinct budget. This service is organised at Garches, on the estate given by the Government to M. Pasteur for the purpose of carrying on his researches on rabies. Its revenue is furnished by the interest on the sum realised by a public subscription, and by a Government grant amounting this year to £3200. The services at the Institute are as follows:—Practical services, consisting of inoculations, &c.; the lectures in this service are given by Dr. Roux and Dr. Metchnikoff. The pupils are of two classes, "hearers" and "workers," who are allowed to work in the laboratories. The research laboratories are placed at the disposal of investigators, whose communications are published in the *Annales de l'Institut Pasteur*. The chiefs are—M. Duclaux for biological chemistry; M. Grancher, M. Charrin, and M. Chantemesse for rabies; M. Chamberland for microbic vaccinations and practical applications. There is a morphological laboratory under the direction of M. Metchnikoff, and a technical one under M. Roux. M. Nocard, professor at Alfort Veterinary School, directs a veterinary service annexed to the Institute. M. Duclaux is professor at the Faculté des Sciences. The course of lectures he previously gave at the Sorbonne are now held at the Pasteur Institute, where the Sorbonne pupils follow him. The Institute was founded in 1888, and retains its constitution and characteristics notwithstanding the death of Pasteur. His pupils will carry on the work.

THE late Mr. John Bell Sedgwick has bequeathed £300 to the Royal Institution in aid of the fund for the promotion of experimental research at low temperatures; and Sir Frederick Abel has given £50 to the same fund.

THE Manchester Museum public lectures continue to attract large audiences. This year there are five courses, each consisting of three lectures; and the first course was brought to a close on Saturday afternoon by an interesting discourse upon "Social Customs and Dwellings," the general subject being "The Elements of Anthropology," and the lecturer Prof. S. J. Hickson. The succeeding lectures are upon Mineralogy, by Dr. Burghardt; Botany, by Prof. F. E. Weiss; Geology, by Prof. Boyd Dawkins; and Zoology, by Mr. W. E. Hoyle. There are now seven handbooks upon the various departments of the Museum, one of which—a handy guide to the whole of the cases—is sold for a penny. The aim of the Professors is to render the lectures educationally valuable, as well as interesting; and the hands of the authorities will be strengthened by a recent grant from the Manchester Corporation of £400, which is to be annual.

THAT certain Hymenoptera and Homoptera secrete wax is well known, and a note by Dr. H. G. Knaggs, in the *Entomologist's Monthly Magazine* for November, indicates that this function can also be performed by Lepidoptera. An investigation of some cells of *Retinia resinana* proved them to contain a very appreciable amount of wax, which formed the lining of the cells. The nature of the lining was demonstrated by dissolving off the resin by immersion in cold rectified spirit, a fluid which appears to have little or no effect upon the wax, so that the latter was thereby exposed to view. "From this it seems to me," concludes Dr. Knaggs, "to be pretty clear that the larva is furnished with the power of secreting wax for the purpose of protecting itself from contact with the tenacious semi-liquid resin exuding from the wound in the fir bud; otherwise, it would inevitably become involved in the sticky medium. Previously to this, however, I was aware that the imagines of certain Lepidoptera contained wax, though I had then formed no idea as to the part played by it in the economy of the insect's life."

GOLD-MINING is showing signs of revival in Victoria, as in many other countries. Forty years ago the colony was the foremost gold-producer in the world, throwing even California into the shade. Although, however, its output has shrunk from over 3,000,000 ozs. in 1856 to 673,000 ozs. last year, it has now, according to the *Annual Report of the Secretary for Mines*, again become a progressive quantity, and the product in 1894 was greater than that in any previous year since 1885. This was due to exceptional causes, the granting to the unemployed of free passes by railway from Melbourne to the various gold-fields having added 15,000 labourers to the number of prospectors and "fossickers." Quartz-mining was less actively pursued in 1894 than in 1893, and the whole gain came from alluvial deposits. Of these, as usual, the most important were the "deep leads" or gravels contained in the beds of Pliocene streams now buried beneath lava flows. In Victoria these gravels are almost exclusively reached by shafts, the deepest of which, at Bendigo, is now down 3122 feet. The Government geologist reports that some extensive systems of deep leads have been discovered and traced out by borings, one system in particular, on the northern side of the Great Dividing Range and to the westward of the meridian of Melbourne, having an aggregate length of forty miles of leads. To work this an enormous capital would be required, and it is proposed to make it a national undertaking, subsidised by the Government.

A VALUABLE paper on the new rubber industry in Lagos appears in the Kew *Bulletin* of Miscellaneous Information (No. 106, October), from which source the following facts were obtained. It is well known that in West Africa there are numerous plants yielding commercial rubber. The chief of these are species of the Apocynaceous genus *Landolphia*, consisting of climbing shrubs, with stems four to six inches in diameter dividing above into numerous branches, and supporting themselves on neighbouring trees. From these, and similar plants, a very important rubber industry was started at the Gold Coast by Sir Alfred Moloney, K.C.M.G., in 1882; and although previous to that year no rubber whatever was exported from that colony, it had attained in 1893 to the annual value of £200,000. This is a remarkable and striking instance of the creation of a new industry by official action, and it deserves to be recorded. In 1882, Sir Alfred Moloney pointed out the possibilities of a similar rubber industry in Lagos, and suggested "the adoption of measures having for their object the addition of one more to the industries of the colony." The result of this was not immediately apparent. But in 1894 the present Governor of Lagos, Sir Gilbert T. Carter, K.C.M.G., induced a party of natives from the Gold Coast, experienced in rubber collecting, to go to Lagos to develop this valuable and important industry. A new rubber-yielding tree, the native name of which is "Ire" or "Irai," was shortly afterwards discovered to be abundantly distributed in the interior forests of the colony. The tree has been identified at Kew as *Kickxia africana*, Benth., and the history of its discovery, and the remarkable influence it has had upon the rubber industry, is full of interest, and illustrates the wonderfully rich resources of the forests of West Africa. The account also shows very clearly how these resources can be developed by judicious and intelligent action on the part of the Government.

A SPECIAL feature of the recent meeting of the British Association at Ipswich was the consideration given to agriculture and allied subjects. As already reported in our columns, a joint sitting of the Sections of Chemistry and Botany was held for the purpose of discussing the relations of agriculture to science. The discussion was opened by Prof. Warington, who read a paper on this subject. Mr. J. Hendrick, of the Glasgow Technical College, and Mr. M. J. R. Dunstan, the Director of Technical Education for Nottingham, also sent papers by way of contributions to the proceedings. One very good feature of this organised discussion was that copies of the opening paper had been freely circulated some time before the meeting, so that the speakers were prepared for the mode of treatment which Prof. Warington adopted. If this plan were more generally followed when discussions at joint sectional sittings were to be held, the value of such meetings would be greatly raised. In response to a widely-expressed desire, the three papers referred to, and a condensed report of the remarks made by the various speakers, have now been reprinted in pamphlet form, and can be had, at a trifling cost, from the Secretary of the British Association, Burlington House, or from the office of the *East Anglian Daily Times*, Carr Street, Ipswich. All who are interested in the agricultural question, from the educational or from the scientific side, will find much material for serious consideration in the various views expressed by a series of speakers of recognised authority.

DR. SIMPSON, Health Officer in Calcutta, in his annual report, refers at some length to Prof. Haffkine's anti-choleraic vaccinations, and expresses himself as very favourably impressed with the treatment, as far as can be judged at this early stage of the inquiry. Some interesting facts are quoted relative to the manner in which the progress of cholera in particular houses seemed to be arrested by inoculation. Thus, in one instance cholera attacked fatally one member of a household; two days later, eleven members of the family out of eighteen were inoculated. "It so happened," continues Dr. Simpson, "that cholera again breaking out in the house, attacking four persons, three of whom died, selected four of the seven not inoculated, while the eleven inoculated remained perfectly free." Again we read that two fatal cases of cholera and two of choleraic diarrhœa occurred in Katal Bagan Basti in a population grouped around the tanks. This outbreak led to the inoculation of 116 persons in the district out of about 200. Since the 116 cases were inoculated, nine more cases of cholera, of which seven were fatal, and one case of choleraic diarrhœa took place. All these ten cases of cholera occurred exclusively among the non-inoculated portion of the inhabitants, and not one of those treated with the vaccine were affected. Dr. Simpson recommends the Commissioners to give the system an extended trial, and he considers that such observations, if carried on in Calcutta on a large scale in its most affected parts during the next one or two years, would solve the question as to its efficacy. As regards the discomfort caused by the inoculations, he states that it is on the whole milder and of shorter duration than that of vaccination against small-pox. Two vaccines are used, one mild and the other strong, and for a complete vaccination two inoculations are necessary, first with the mild vaccine, which produces some pain at the seat of inoculation, or discomfort and fever for about one day; after a period of five days the second inoculation takes place with the stronger vaccine, which produces a similar form of malaise to that caused by the first inoculation. The harmlessness of the treatment has been established beyond question.

AS one of the results of a long piece of work carried out in the botanical laboratory of Trinity College, Dublin, Mr. Henry H. Dixon believes that his preparations of the pollen-mother-cells of *Lilium longiflorum* before their first division show that origin of the double nuclear thread is not from the cleavage longitudinally of an originally single thread, but from the approximation of portions of the single thread, so that these portions come to lie more or less parallel to one another. When the thread breaks into the chromosomes the divisions affects both portions, so that each chromosome is composed of two more or less parallel pieces. These pieces may lie side by side, or may be fused together at one end while the other ends are somewhat parted asunder, or they may be bent in such a manner that they come to lie across one another in two or three places, or they may be fused together at both ends. As the chromosomes arrange themselves in the equator they become shorter and thicker, and they are so disposed that the plane of separation between their two parts lies vertically, and consequently they appear double when viewed from the polar aspect. At this stage, when seen from the equatorial plane, they have the appearance of short thick rods. Later on, horizontal fission takes place in each, beginning from the inner end. As this proceeds they assume the **T**-shape described by Belajeff. The daughter chromosomes have the **V**-shape as they leave the nuclear plate, having passed through stages similar to those described by this author. As they approach the poles each **V**-shaped chromosome cleaves transversely at the angle, and breaks into two short straight rods, so that at the poles there appear to be twice as many chromosomes as in the nuclear plate. Thus it appears probable, both from the origin of the two portions of the chromosomes forming the nuclear plate, and the subsequent division of the daughter chromosomes at the poles, that each chromosome of this mitosis corresponds to two chromosomes of previous nuclear divisions fused more or less completely end to end. The division following, to form the pollen-tetrads, was not observed in this plant, but it probably conforms in its details to the normal karyokinesis in plant cells, as in *Lilium Martagon* and *L. chalcedonicum* it was followed, and the normally-proportioned chomosomes undergoing longitudinal fission in the nuclear plate were observed.

A LONG paper on the working of iron and steel, by M. E. Demenge, appears in the *Revue Générale des Sciences* for October 15 and 30. The article is illustrated by twelve full-page plates, chiefly representing modern forging and rolling machinery.

IN *Botany Bulletin*, No. 11, of the Department of Agriculture, Brisbane, Mr. F. M. Bailey gives a complete list of the Freshwater Algæ of Queensland, including descriptions of several new species.

MR. G. MASSEE has reprinted from the *Annals of Botany* his paper on the "Spot-disease of Orchids," which shows that the disease is not of a parasitic nature, the initial cause being the presence of minute drops of water on the surface of the leaves at a time when the temperature is exceptionally low and the roots copiously supplied with water.

WE have received a further communication from Mr. Radcliffe, the inventor of the "38" puzzle (NATURE, No. 1352, p. 525), in which he shows how, by the sacrifice of his three extra symmetrical arrangements, the maximum number of 15 straight lines (all totalling to 38) can be obtained. He points out also some other symmetrical arrangements.

The first edition of "Practical Physiology of Plants" (Cambridge University Press), by Mr. F. Darwin, F.R.S., and Mr. E. Hamilton Acton, was published a year ago. The work has been appreciated from the outset, and so great has been the demand for it that it has been out of print for a little time. A second edition has, however, just been published; but with our pleasure that the merits of the book have been recognised, must be mingled regret that the death of Mr. Acton should have prevented him from seeing its success.

The forthcoming number of the *Physical Review* (November-December) will contain the following articles:—"Variation in Electric Conductivity of Metallic Wires in Different Dielectrics," by Fernando Sanford; "A Study of the Polarisation of the Light emitted by Incandescent Solid and Liquid Surfaces" (II.), by R. A. Millikan; "On Ternary Mixtures" (III.), by W. D. Bancroft; "On the Changes in Length produced in Iron Wires by Magnetisation," by L. T. More. Among the minor contributions will be: "The Limits of Pitch for the Human Voice," by W. Le Conte Stevens; "The New Physics Laboratory at Lille," by E. L. Nichols.

The *Quarterly Journal* of the Geological Society (No. 204, November), just published, is illustrated by twelve plates. The contents of the number include a paper on the geology of Mount Ruwenzori and some adjoining regions of Equatorial Africa, by Mr. G. F. Scott Elliot and Dr. J. W. Gregory. Mr. A. Strahan explains overthrusts of Tertiary-beds in Dorset, and Mr. G. W. Lamplugh describes the "Crush-Conglomerates" of the Isle of Man, while Mr. W. W. Watts writes on the petrography of the same. The other authors and papers are: Messrs. W. Hill and A. J. Jukes-Brown, on the occurrence of Radiolaria in Chalk; and Dr. G. J. Hinde and Mr. H. Fox, on Radiolarian rocks in the Lower Culm Measures.

The Meteorological Council have published the hourly means of the readings obtained from the self-recording instruments at the five observatories under their control, for the year 1891. The present volume contains the values for an additional observatory —Fort William, the low-level station of the Ben Nevis Observatory. An additional table has also been added to the series, containing hourly sunshine values, and in an appendix will be found the results of an hourly tabulation of the sunshine cards for the ten years 1881-90, for seven stations, illustrated by coloured plates. A summary of the hourly and seasonal variation of sunshine, based upon these values, was submitted to the Royal Meteorological Society, by Mr. R. H. Curtis, on June 19, a report of which appeared in our issue of the 27th of that month (p. 215).

In connection with the recent jubilee celebrations at the Royal Agricultural College, Cirencester, which were attended by the Prince of Wales, as patron of the institution, a special effort was made to issue a number of the *Agricultural Students' Gazette* which should be worthy of the occasion. Several past professors of the college responded to the editor's call for co-operation, and accordingly we find articles on "Anbury, Club-root, or Finger-and-toe," by Mr. W. T. Thiselton-Dyer; on "The Rise and Progress of Veterinary Science in its Relation to Agriculture," by Prof. G. T. Brown; and on "Meadows and Pastures," by Dr. W. Fream. Old students are represented by Sir Jacob Wilson, who writes on the "Progress of Agricultural Education." Prof. Warington has a paper on "Organisms in Soil assimilating Nitrogen from the Atmosphere"; and amongst other subjects dealt with are the breeding of Shires, our meat supply, estate fences, curd making, chlorine in rain-water, and Samuel Hartlib and his "Legacie."

The additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Mrs. Jackson; three Red-backed Pelicans (*Pelecanus rufescens*) from East Africa, presented by Mr. F. E. C. Remington; two Verticillated Geckos (*Gecko verticillatus*) from Burmah, presented by Mr. H. Champion; a Common Boa (*Boa constrictor*) from South America, presented by Mr. F. J. Mitchell; a Whimbrel (*Numenius phæops*), European, presented by Messrs. Mason; a Black-faced Spider Monkey (*Ateles ater*) from Eastern Peru, a Brown Capuchin (*Cebus fatuellus*) from Guiana, deposited; two Black-tailed Flower-Birds (*Anthornis melanura*) from New Zealand, two Silver Pheasants (*Euplocamus nycthemerus*) from China, purchased; a White-tailed Gnu (*Connochætes gnu*, ♂) from South Africa, received in exchange.

OUR ASTRONOMICAL COLUMN.

Stars with Bright and Dark Hydrogen Lines.—In his observations of the spectrum of the well-known bright line star γ Argus during 1893-94, Prof. Campbell noted the remarkable fact that whilst the red line of hydrogen was quite bright, the hydrogen lines in the violet were dark. The same peculiarity was also observed in the spectrum of η Tauri.

Since then Prof. Campbell has observed the spectra of all the available stars showing the F line bright in their spectra, and in some cases has secured successful photographs; from a consideration of the results obtained, he claims to have established the following points. (1) Some stars contain both bright and dark hydrogen lines. (2) The bright lines in such stars are those of greater wave-length, the dark lines are those of shorter wave-length. (3) The intensities of the bright lines decrease as we approach the violet. (4) The intensities of the dark lines increase as we go to the violet. (*Astrophysical Journal*, vol. ii. No. 3, p. 177).

In the case of γ Cassiopeiæ, Prof. Campbell finds the bright hydrogen lines to diminish very rapidly in intensity in the more refrangible part of the spectrum, and observes that they are situated within broad dark hydrogen lines; he does not, however, appear to have noticed the additional feature of the duplication of the bright lines in the spectrum of this star as photographed at Kensington (Nature, vol. li. p. 425), although he records a similar appearance in the spectrum of ϕ Persei.

As to the explanation of the somewhat strange behaviour of the hydrogen lines, Prof. Campbell revives a suggestion due to Prof. Frost, namely, that the *selective* absorption of a star's atmosphere may be greater for the more refrangible rays, just as the *general* absorption of the sun's atmosphere is greater for such rays, the character of a spectrum being the resultant of radiation and absorption phenomena.

As first pointed out in connection with the meteoritic hypotheses, these stars represent a very early stage in sidereal evolution, and we note that Prof. Campbell adopts this view. He finds also that the variations of spectrum in passing from one star to another indicate that many steps in the evolutionary process are represented.

Parallaxes of Stellar Systems.—The possibility of determining the parallax of a binary star, and hence the dimensions and mass of the system, by a spectroscopic observation of the relative velocity in the line of sight, was first pointed out by Fox Talbot in 1871, but the suggestion has not yet borne fruit. Some hesitation in taking up this interesting piece of work has no doubt been due to the smallness of the velocity to be measured in most cases; but now that such a high degree of accuracy is attainable, there is no longer any reason to suppose the method impracticable. A very simple way of computing the parallax from an observed velocity in the line of sight was introduced by Dr. Rambaut a few years ago, a knowledge of the orbital elements being assumed (*Monthly Notices*, vol. l. p. 302). This paper seemed to supply all that was needful in the way of facilitating the necessary computations; but Dr. See has recently treated the subject somewhat differently (*Ast. Nach.*, No. 3314). The hodograph of an ellipse being a circle, the velocity at any point in the ellipse is represented by the radius vector of the hodograph which is parallel to the tangent to the orbit at the point in question. The radius of the hodograph can be determined from the spectroscopically observed velocity, and the value of the velocity in the line of sight can then be predicted